

# A Modified Method for Determining Free Fatty Acids from Small Soybean Oil Sample Sizes

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**ABSTRACT:** A modification of the AOCS Official Method Ca 5a-40 for determination of free fatty acids (FFA) in 0.3 to 6.0-g samples of refined and crude soybean oil is described. The modified method uses only about 10% of the weight of oil sample, alcohol volume, and alkali strength recommended in the Official Method. Standard solutions of refined and crude soybean oil with FFA concentrations between 0.01 and 7.5% were prepared by adding known weights of oleic acid. The FFA concentrations, determined from small sample sizes with the modified method, were compared with FFA percentages determined from larger sample sizes with the Official Method. Relationships among determinations obtained by the modified and official methods, for both refined and crude oils, were described by linear functions. The relationship for refined soybean oil had an  $R^2$  value of 0.997 and a slope of  $0.99 \pm 0.031$ . The values for crude soybean oil are defined by a line with  $R^2 = 0.9996$  and a slope of  $1.01 \pm 0.013$ . JAOCS 75, 563-568 (1998).

**KEY WORDS:** Crude soybean oil, free fatty acid, Official Method, refined soybean oil, titration.

In the soybean industry, the presence and development of any amount of free fatty acid (FFA) in soybean oil is undesirable. The FFA content of oil in soybeans indicates how well the beans have been treated during the period between harvest and processing. The eventual consequence of high FFA content is monetary loss because processing soybeans with high FFA content results in more refining loss. Specifically, refining loss is the sum of oil weight lost during removal of FFA and other impurities plus the weight of entrained neutral oil in soapstock during the normal alkali-refining process. The percentage of oil lost during refining can be estimated as a multiple of the FFA percentage. Norris (1) estimates the potential loss at about three times the FFA content. Because of the economic impact of high FFA, it is important to determine the initial level of FFA in soybean oil and also to monitor its concentration during processing.

The standard method for FFA determination in extracted crude and refined soybean oil samples is based on an acid-

base titration technique in a nonaqueous system. The method commonly used is AOCS Official Method Ca 5a-40 (2). The procedure prescribes an oil sample of maximum 56.4 g and minimum 3.53 g for the titration, depending on the level of FFA in the oil sample. When oil quantities are limited, as in some storage studies or when experimental use of oilseed crops is evaluated, sample sizes of this magnitude are not possible. A simple and inexpensive method is needed that accurately quantifies FFA content from a smaller sample size.

The use of smaller amounts of chemicals will have an impact, especially in developing countries, where chemicals are scarce and expensive. Also, it is prudent to limit the use of resources, particularly those hazardous to the environment. For example, hexane, a solvent used in the titration, is a hazardous, highly flammable compound, and its disposal can be harmful to the environment. A smaller sample size also would result in savings of storage space in laboratories that handle large numbers of samples, or if the protocol warrants that oil samples be kept after analysis.

Lanser *et al.* (3) developed a user-interactive computer-assisted Fourier transform infrared (FTIR) method to estimate FFA content in soybean oil samples. The method requires only one drop of soybean oil. The limitation of the method, and other similar spectrometric methods, such as that described by Canham and Pacey (4), is the cost of the instruments; it is prohibitive for most laboratories. Lanser *et al.* (3) also evaluated a modified version of the Official Method in which between 6 and 7 g of oil is used, but no further description of the method was given. The coefficient of determination ( $R^2$ ) of the modified method was 0.999. The high correlation indicates that the officially recommended sample size can be scaled down without losing accuracy of FFA determination.

The objective of this research was to develop and evaluate a method for determining FFA concentration within the range of 0.01 to 7.5% in soybean oil by using an oil sample of about 10% (between 0.3 and 6.0 g) of the weight recommended in the AOCS Official Method.

## MATERIALS AND METHODS

Different amounts of oleic acid were added to refined-bleached-deodorized (RBD) and crude soybean oil samples

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E-mail: cjb@iastate.edu.

# Aoac Methods Manual For Fatty Acids

**Briony Thomas,Jacki Bishop**



## **Aoac Methods Manual For Fatty Acids:**

*Handbook of Food Science, Technology, and Engineering - 4 Volume Set* Y. H. Hui, Frank Sherkat, 2005-12-19 Advances in food science technology and engineering are occurring at such a rapid rate that obtaining current detailed information is challenging at best While almost everyone engaged in these disciplines has accumulated a vast variety of data over time an organized comprehensive resource containing this data would be invaluable to have The *Food Analysis Laboratory Manual* S. Suzanne Nielsen, 2017-06-07 This third edition laboratory manual was written to accompany Food Analysis Fifth Edition by the same author New to this third edition of the laboratory manual are four introductory chapters that complement both the textbook chapters and the laboratory exercises The 24 laboratory exercises in the manual cover 21 of the 35 chapters in the textbook Many of the laboratory exercises have multiple sections to cover several methods of analysis for a particular food component or characteristic Most of the laboratory exercises include the following background reading assignment objective principle of method chemicals reagents precautions and waste disposal supplies equipment procedure data and calculations questions and references This laboratory manual is ideal for the laboratory portion of undergraduate courses in food analysis **Instrumental Methods in Food and Beverage Analysis** D.L.B. Wetzal, G.

Charalambous, 1998-05-29 Advances in instrumentation and applied instrumental analysis methods have allowed scientists concerned with food and beverage quality labeling compliance and safety to meet ever increasing analytical demands Texts dealing with instrumental analysis alone are usually organized by the techniques without regard to applications The biannual review issue of Analytical Chemistry under the topic of Food Analysis is organized by the analyte such as N and protein carbohydrate inorganics enzymes flavor and odor color lipids and vitamins Under flavor and odor the subdivisions are not along the lines of the analyte but the matrix e g wine meat dairy fruit in which the analyte is being determined In Instrumentation in Food and Beverage Analysis the reader is referred to a list of 72 entries entitled Instrumentation and Instrumental Techniques among which molecular spectroscopy chromatographic and other sophisticated separations in addition to hyphenated techniques such as GS Mass spectrometry A few of the entries appear under a chapter named for the technique Most of the analytical techniques used for determination separations and sample work prior to determination are treated in the context of an analytical method for a specific analyte in a particular food or beverage matrix with which the author has a professional familiarity dedication and authority Since in food analysis in particular it is usually the food matrix that presents the research analytical chemist involved with method development the greatest challenge Nielsen's Food Analysis Laboratory Manual B. Pam Ismail, S. Suzanne Nielsen, 2024-06-20 This fourth edition laboratory manual was written to accompany Nielsen's Food Analysis Sixth Edition by the same authors New to this fourth edition of the laboratory manual are three new chapters that complement both the textbook chapters and the laboratory exercises The book again contains four introductory chapters that help prepare students for doing food analysis laboratory exercises The 26 laboratory

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Nollet,2004-06-01 This two volume handbook supplies food chemists with essential information on the physical and chemical properties of nutrients descriptions of analytical techniques and an assessment of their procedural reliability The new edition includes two new chapters that spotlight the characterization of water activity and the analysis of inorganic nutri

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Enfant Concerted Action Project within the framework of the FLAIR Food Linked Agro Industrial Research Programme of the Commission of the European Communities It was quickly recognised that the draft guidelines for the production management and use of food composition data which had been prepared under the aegis of INFOODS International Network of Food Data Systems a project of the United Nations University would be especially applicable to the objectives of the Concerted Action The guidelines have been written by two recognised experts Many people associated with FLAIR Eurofoods Enfant have added constructive criticism and advice to that offered previously by those associated with INFOODS Thus the guidelines are backed by a consensus in the community of those responsible for the production and use of food composition tables and nutrient data bases

*Manual of Dietetic Practice* Briony Thomas,Jacki Bishop,2013-07-08 The standard work for all those involved in the field of clinical nutrition and dietetics The Manual of Dietetic Practice has been equipping health care professionals with the essential foundations on which to build expertise and specialist skill since it was first published in 1988 The fourth edition responds to the changing demand for multidisciplinary patient centred evidence based practice and has been expanded to include dedicated chapters covering adult nutrition freelance dietetics complementary and alternative therapies Compiled from the knowledge of both individual experts and the British Dietetic Association s Specialist Groups this truly is the essential guide to the principles of dietetics across its whole range

*Food Additives Analytical Manual* United States. Food and Drug Administration,1983

**Selected Technical Publications** ,1977

**Marine Fisheries Review** ,1980

Listeria, Listeriosis, and Food Safety Elliot T. Ryser,Elmer H. Marth,2007-03-27 Completely revised the new edition of this bestseller incorporates recent findings to present readers with a complete and current overview of foodborne listeriosis including information on listeriosis in animals and humans pathogenesis methods of detection and subtyping Two new chapters deal with risk assessment cost of outbreaks regulatory control in various countries and future directions for research The text covers many high risk foods including fermented and unfermented dairy products meat poultry fish seafood and products of plant origin This authoritative resource has proven in to be a critical tool for those involved with preventing and curbing outbreaks of this dangerous pathogen

Automated Sample Preparation Hans-Joachim Hubschmann,2022-02-22 An essential guide to the proven automated sample preparation process While the measurement step in sample preparation is automated the sample handling step is manual and all too often open to risk and errors The manual process is of concern for accessing data quality as well as producing limited reproducibility and comparability Handbook of Automated Sample Preparation for CG MS and LC MS explores the advantages of implementing automated sample preparation during the handling phase for CG MS and LC MS The author a noted expert on the topic includes information on the proven workflows that can be put in place for many routine and regulated analytical methods This book offers a guide to automated workflows for both on line and off line sample preparation This process has proven to deliver consistent and comparable data quality increased sample amounts and improved cost efficiency In addition the

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**Selected Technical Publications** United States. Food and Drug Administration,1970 Each no represents the results of the FDA research programs for half of the fiscal year **Commercial Fisheries Abstracts** ,1970 **Federal Register** ,2006-03 Fair Packaging & Labeling Act United States. Food and Drug Administration,1981 *Human Milk and Lactation* Maria Lorella Gianni,2020-05-28 Human milk is uniquely tailored to meet infants specific nutritional requirements However it is more than just milk This dynamic and bioactive fluid allows mother infant signalling over lactation guiding the infant in the developmental and physiological processes It exerts protection and life long biological effects playing a crucial role in promoting healthy growth and optimal cognitive development The latest scientific advances have provided insight into different components of human milk and their dynamic changes over time However the complexity of human milk composition and the synergistic mechanisms responsible for its beneficial health effects have not yet been unravelled Filling this knowledge gap will shed light on the biology of the developing infant and will contribute to the optimization of infant feeding particularly that of the most vulnerable infants Greater understanding of human milk will also help in elucidating the best strategies for its storage and handling The increasing knowledge on human milk s bioactive compounds together with the rapidly advancing technological achievements will greatly enhance their use as prophylactic or therapeutic agents The current Special Issue aims to welcome original works and literature reviews further exploring the complexity of human milk composition the mechanisms underlying the beneficial effects associated with breastfeeding and the factors and determinants involved in lactation including its promotion and support

*Tortillas: Wheat Flour and Corn Products* LW Rooney,Sergio O. Serna-Saldivar,2015-01-01 Corn and wheat are among the most important cereals worldwide representing many of the calories and proteins consumed Tortillas and tortilla related products are among the fastest growing segments of the food industry and represent a sizeable portion of those calories Tortillas Wheat Flour and Corn Products answers the food industry s need to meet the growing demand for high quality tortillas and tortilla based foods This book will guide food scientists product developers and nutritionists through the fascinating science and technology behind the production of corn and wheat flour tortillas This title is the most comprehensive English language book of its kind It fully describes the technology nutritional value and quality control measures of corn and wheat flour tortillas tortilla chips and related products It accomplishes this through 300 pages

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